MOFFAT
COLLECTION SYSTEM PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT

Appendix D:
Construction Information

Photo provided courtesy of Denver Water.

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Appendix D:
Construction Information

Photo provided courtesy of Denver Water.

- D-1 Estimated Construction Schedules
- D-2 Tables of Estimated Ground Disturbance by Alternative

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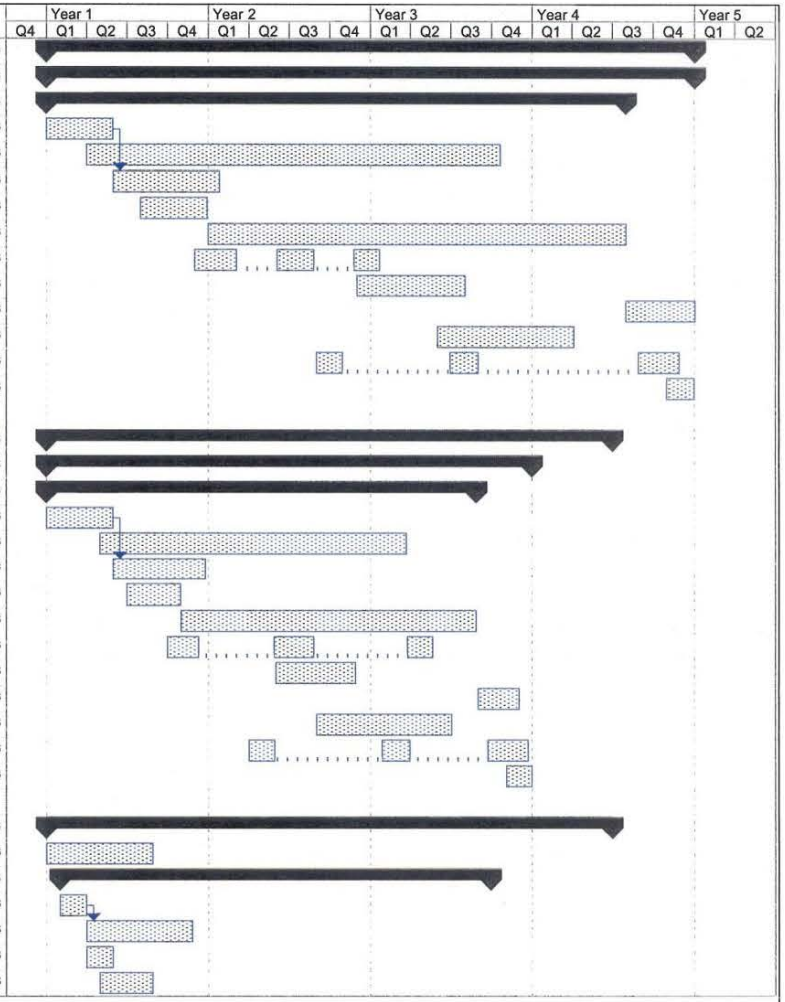
Appendix D-1
Estimated Construction Schedules

(Proposed Action)

ID	Task Name	Duration
1	**Alternative 1a**	**1064 days**
2	**Enlarged Gross Reservoir (Additional 72,000 AF)**	**1064 days**
3	Dam Construction	**954 days**
4	Mobilization	111 days
5	Developing Borrow Areas and Stockpiles	684 days
6	Foundation Excavation	177 days
7	Foundation Grouting	111 days
8	Concrete Placement	684 days
9	Road Relocations and Bridges	177 days
10	Auxiliary Spillway	177 days
11	Filling and Testing	111 days
12	Recreation Facilities	222 days
13	Reclamation	155 days
14	Demobilization	44 days
15		
16	**Alternative 1c**	**933 days**
17	**Enlarged Gross Reservoir (Additional 40,700 AF)**	**802 days**
18	Dam Construction	**712 days**
19	Mobilization	111 days
20	Developing Borrow Areas and Stockpiles	508 days
21	Foundation Excavation	155 days
22	Foundation Grouting	89 days
23	Concrete Placement	488 days
24	Road Relocations and Bridges	163 days
25	Auxiliary Spillway	132 days
26	Filling and Testing	67 days
27	Recreation Facilities	222 days
28	Reclamation	155 days
29	Demobilization	42 days
30		
31	**New Leyden Gulch Reservoir (Additional 31,300 AF)**	**933 days**
32	Highway 93 Relocation	177 days
33	Dam Construction	**712 days**
34	Mobilization	44 days
35	Developing Borrow Areas	177 days
36	Clearing and Grubbing	44 days
37	Foundation Treatment	88 days



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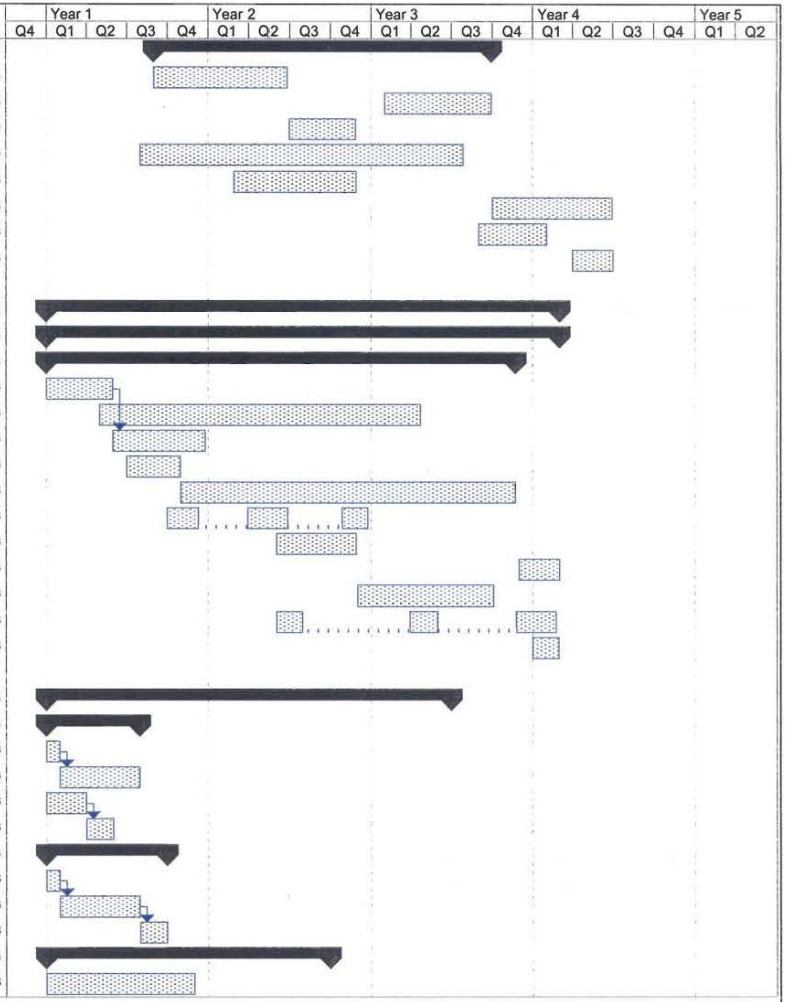
ID	Task Name	Duration
38	Embankment Construction	**556 days**
39	Phase 1	223 days
40	Phase 2	175 days
41	Spillway	109 days
42	Tunnels and Connection to 16 & 22	532 days
43	Intake Tower and Outlet Works	199 days
44	South Boulder Canal Reroute	195 days
45	Reclamation	111 days
46	Demobilization	66 days
47		
48	**Alternative 8a**	**846 days**
49	**Enlarged Gross Reservoir (Additional 52,000 AF)**	**846 days**
50	Dam Construction	**773 days**
51	Mobilization	111 days
52	Developing Borrow Areas and Stockpiles	530 days
53	Foundation Excavation	155 days
54	Foundation Grouting	89 days
55	Concrete Placement	549 days
56	Road Relocations and Bridges	163 days
57	Auxiliary Spillway	132 days
58	Filling and Testing	67 days
59	Recreation Facilities	222 days
60	Reclamation	155 days
61	Demobilization	42 days
62		
63	**Reusable South Platte River Return Flows in Gravel Pit Storage**	**670 days**
64	**South Platte River Diversion**	**156 days**
65	Mobilization	23 days
66	Concrete Diversion	133 days
67	Pipeline Fabrication	67 days
68	Pipeline to Gravel Pit Storage (750 feet of 54-inch)	45 days
69	**Gravel Pit Storage (5,000 AF)**	**201 days**
70	Mobilization	23 days
71	Inlet/Outlet Works	133 days
72	Reclamation	44 days
73	**Pump Stations (3- 2,000Hp)**	**472 days**
74	Material Acquisition	247 days



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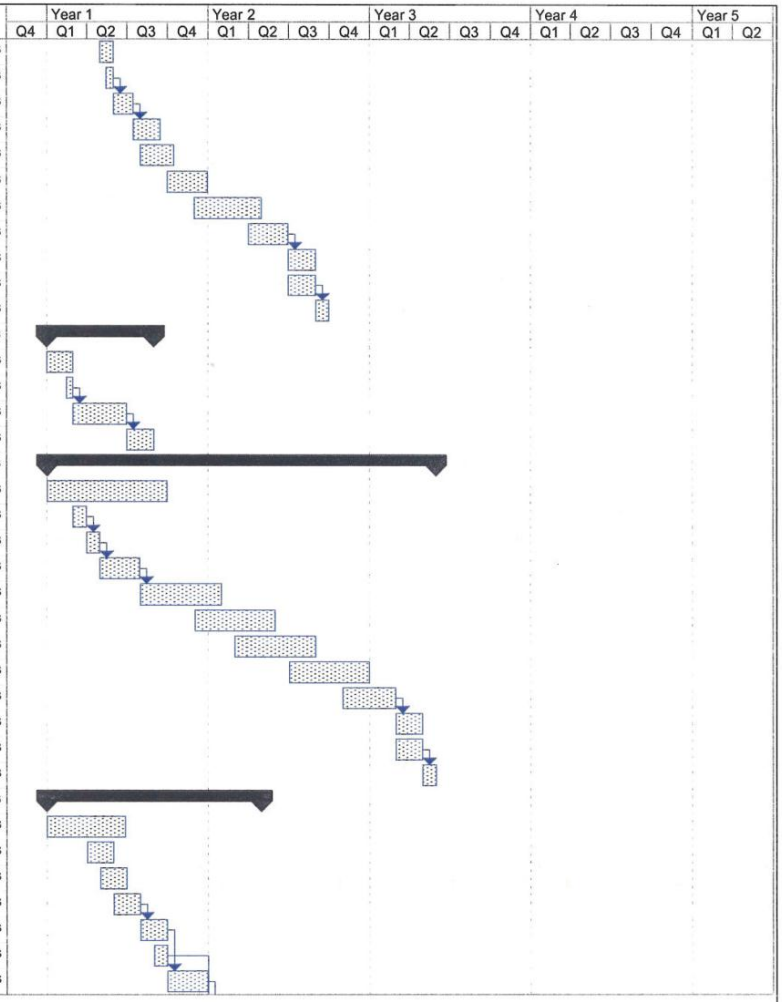
ID	Task Name	Duration
75	Mobilization	23 days
76	Clearing and Grubbing	13 days
77	Excavation	33 days
78	Concrete Placement	45 days
79	Piping and Below-Grade Utilities Installation	55 days
80	Above-Grade Structure Construction	69 days
81	Mechanical and Electrical Equipment Installation	114 days
82	Controls Systems Installation	66 days
83	Testing and Commissioning	45 days
84	Landscaping	45 days
85	Demobilization	22 days
86	**Gravel Pit Pipeline (1.4 miles of 36-inch)**	**179 days**
87	Begin Production of Materials	44 days
88	Mobilization	11 days
89	Install Pipe	90 days
90	Hydrotest, Commission, Clean-up, and Demobilization	45 days
91	**Water Treatment Plant (13.6 MGD)**	**647 days**
92	Material Acquisition	200 days
93	Mobilization	23 days
94	Clearing and Grubbing	22 days
95	Excavation	67 days
96	Concrete Placement	136 days
97	Piping and Below-Grade Utilities Installation	134 days
98	Above-Grade Structure Construction	132 days
99	Mechanical and Electrical Equipment Installation	132 days
100	Controls Systems Installation	87 days
101	Testing and Commissioning	45 days
102	Landscaping	45 days
103	Demobilization	22 days
104	**Dechlorination Facility**	**361 days**
105	Material Acquisition	133 days
106	Mobilization	44 days
107	Clearing and Grubbing	44 days
108	Excavation	45 days
109	Concrete Placement	44 days
110	Piping and Below-Grade Utilities Installation	22 days
111	Above-Grade Structure Construction	69 days



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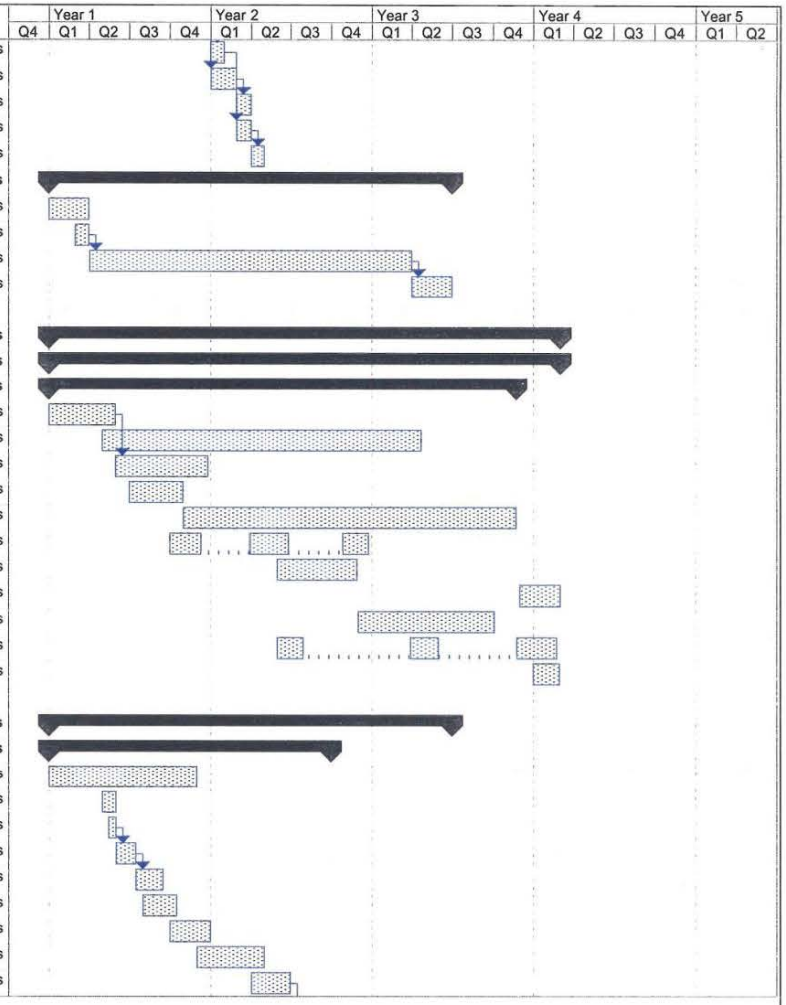
ID	Task Name	Duration
112	Mechanical and Electrical Equipment Installation	23 days
113	Controls Systems Installation	45 days
114	Testing and Commissioning	23 days
115	Landscaping	23 days
116	Demobilization	22 days
117	**Conduit O (25 miles of 36-inch)**	**670 days**
118	Begin Production of Materials	67 days
119	Mobilization	23 days
120	Install Pipe	535 days
121	Hydrotest, Commission, Clean-up, and Demobilization	66 days
122		
123	**Alternative 10a**	**846 days**
124	**Enlarged Gross Reservoir (Additional 52,000 AF)**	**846 days**
125	Dam Construction	**773 days**
126	Mobilization	111 days
127	Developing Borrow Areas and Stockpiles	530 days
128	Foundation Excavation	155 days
129	Foundation Grouting	89 days
130	Concrete Placement	549 days
131	Road Relocations and Bridges	163 days
132	Auxiliary Spillway	132 days
133	Filling and Testing	67 days
134	Recreation Facilities	222 days
135	Reclamation	155 days
136	Demobilization	42 days
137		
138	**Aquifer Storage and Recovery System**	**670 days**
139	**Pump Stations (3- 2,000Hp)**	**472 days**
140	Material Acquisition	247 days
141	Mobilization	23 days
142	Clearing and Grubbing	13 days
143	Excavation	33 days
144	Concrete Placement	45 days
145	Piping and Below-Grade Utilities Installation	55 days
146	Above-Grade Structure Construction	69 days
147	Mechanical and Electrical Equipment Installation	114 days
148	Controls Systems Installation	66 days



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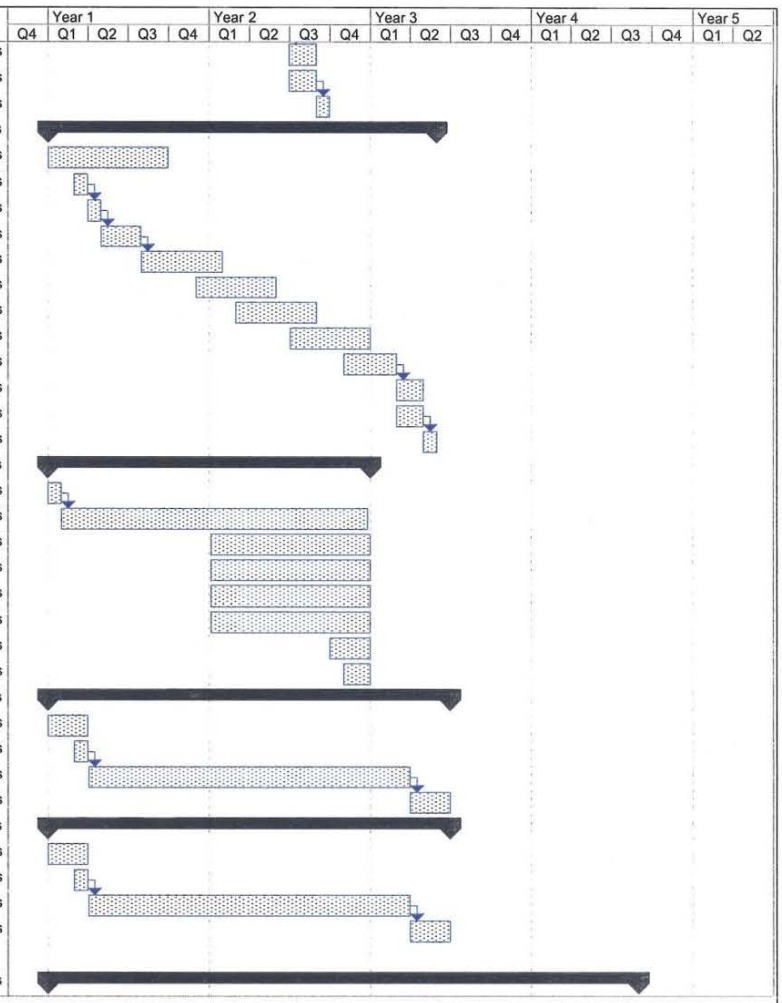
ID	Task Name	Duration
149	Testing and Commissioning	45 days
150	Landscaping	45 days
151	Demobilization	22 days
152	**Water Treatment Plant (13.6 MGD)**	**647 days**
153	Material Acquisition	200 days
154	Mobilization	23 days
155	Clearing and Grubbing	22 days
156	Excavation	67 days
157	Concrete Placement	136 days
158	Piping and Below-Grade Utilities Installation	134 days
159	Above-Grade Structure Construction	132 days
160	Mechanical and Electrical Equipment Installation	132 days
161	Controls Systems Installation	87 days
162	Testing and Commissioning	45 days
163	Landscaping	45 days
164	Demobilization	22 days
165	**ASR Wells (27 sites, 81 wells)**	**539 days**
166	Mobilization	23 days
167	Well Drilling	512 days
168	Well House Construction	266 days
169	Pump and Motor Installation	266 days
170	Electrical Equipment Installation	266 days
171	Controls System Installation	266 days
172	Landscaping	67 days
173	Demobilization	45 days
174	**ASR Distribution Pipelines (36 miles of 12-48-inch)**	**670 days**
175	Begin Production of Materials	67 days
176	Mobilization	23 days
177	Install Pipe	535 days
178	Hydrotest, Commission, Clean-up, and Demobilization	66 days
179	**Conduit M (18.5 miles of 36-inch)**	**670 days**
180	Begin Production of Materials	67 days
181	Mobilization	23 days
182	Install Pipe	535 days
183	Hydrotest, Commission, Clean-up, and Demobilization	66 days
184		
185	**Alternative 13a**	**977 days**



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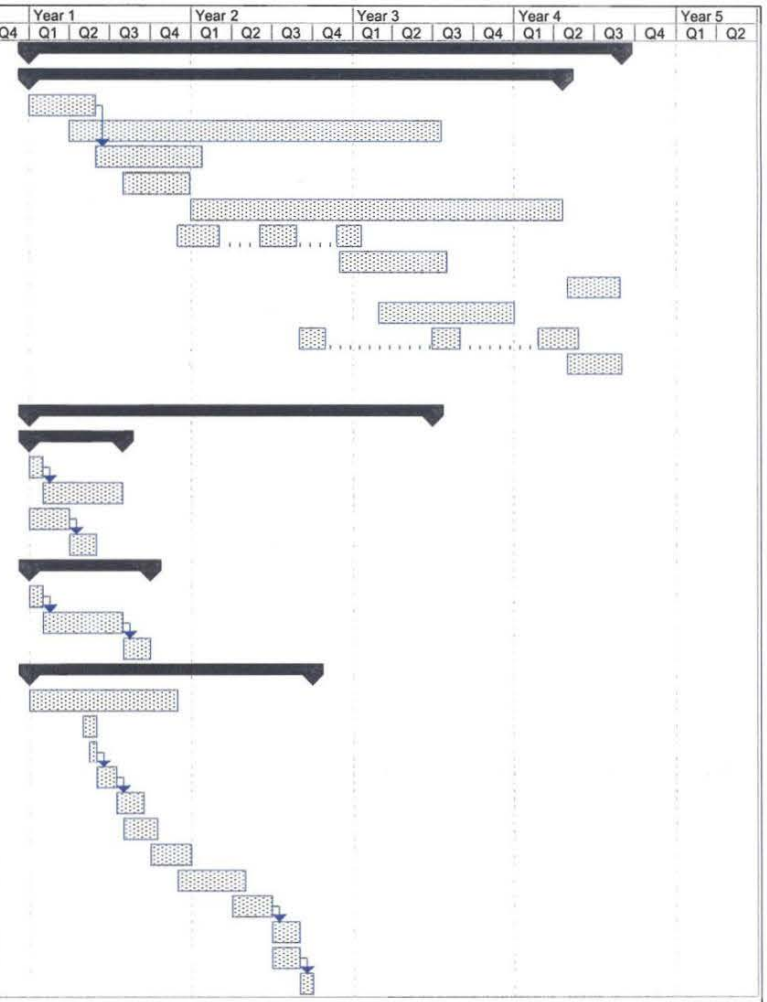
ID	Task Name	Duration
186	**Enlarged Gross Reservoir (Additional 60,000 AF)**	**977 days**
187	Dam Construction	**882 days**
188	Mobilization	111 days
189	Developing Borrow Areas and Stockpiles	617 days
190	Foundation Excavation	177 days
191	Foundation Grouting	111 days
192	Concrete Placement	612 days
193	Road Relocations and Bridges	177 days
194	Auxiliary Spillway	177 days
195	Filling and Testing	86 days
196	Recreation Facilities	222 days
197	Reclamation	155 days
198	Demobilization	89 days
199		
200	**Reusable South Platte River Return Flows in Gravel Pit Storage**	**670 days**
201	**South Platte River Diversion**	**156 days**
202	Mobilization	23 days
203	Concrete Diversion	133 days
204	Pipeline Fabrication	67 days
205	Pipeline to Gravel Pit Storage (750 feet of 54-inch)	45 days
206	**Gravel Pit Storage (5,000 AF)**	**201 days**
207	Mobilization	23 days
208	Inlet/Outlet Works	133 days
209	Reclamation	44 days
210	**Pump Stations (3- 1,500Hp)**	**472 days**
211	Material Acquisition	247 days
212	Mobilization	23 days
213	Clearing and Grubbing	13 days
214	Excavation	33 days
215	Concrete Placement	45 days
216	Piping and Below-Grade Utilities Installation	55 days
217	Above-Grade Structure Construction	69 days
218	Mechanical and Electrical Equipment Installation	114 days
219	Controls Systems Installation	66 days
220	Testing and Commissioning	45 days
221	Landscaping	45 days
222	Demobilization	22 days



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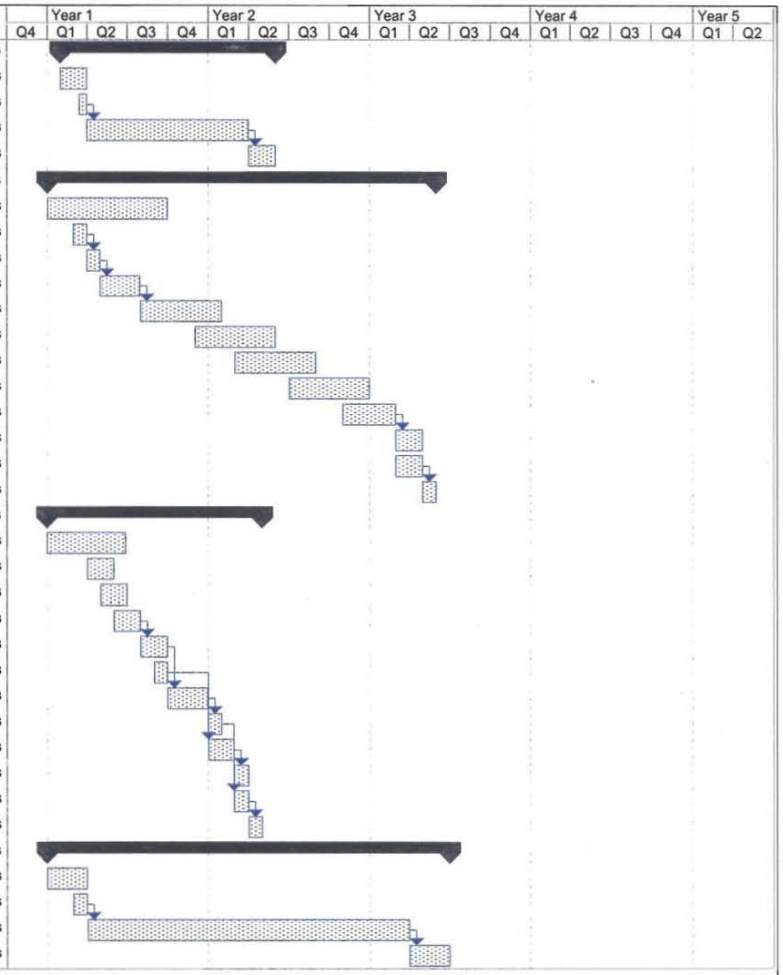
ID	Task Name	Duration
223	**Gravel Pit Pipeline (5-miles of 30-inch)**	**361 days**
224	Begin Production of Materials	44 days
225	Mobilization	12 days
226	Install Pipe	272 days
227	Hydrotest, Commission, Clean-up, and Demobilization	45 days
228	**Water Treatment Plant (10.5 MGD)**	**647 days**
229	Material Acquisition	200 days
230	Mobilization	23 days
231	Clearing and Grubbing	22 days
232	Excavation	67 days
233	Concrete Placement	136 days
234	Piping and Below-Grade Utilities Installation	134 days
235	Above-Grade Structure Construction	132 days
236	Mechanical and Electrical Equipment Installation	132 days
237	Controls Systems Installation	87 days
238	Testing and Commissioning	45 days
239	Landscaping	45 days
240	Demobilization	22 days
241	**Dechlorination Facility**	**362 days**
242	Material Acquisition	133 days
243	Mobilization	44 days
244	Clearing and Grubbing	44 days
245	Excavation	45 days
246	Concrete Placement	44 days
247	Piping and Below-Grade Utilities Installation	22 days
248	Above-Grade Structure Construction	69 days
249	Mechanical and Electrical Equipment Installation	23 days
250	Controls Systems Installation	45 days
251	Testing and Commissioning	23 days
252	Landscaping	23 days
253	Demobilization	23 days
254	**Conduit O (25 miles of 30-inch)**	**670 days**
255	Begin Production of Materials	67 days
256	Mobilization	23 days
257	Install Pipe	535 days
258	Hydrotest, Commission, Clean-up, and Demobilization	66 days



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Appendix D-2
Tables of Estimated Ground Disturbance by Alternative

Appendix D-2
Tables of Estimated Ground Disturbance by Alternative

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Table D-1
Estimated Ground Disturbance (Acres) - Gross Reservoir
Alternatives 1a (Proposed Action), 1c, 8a, 10a, and 13a

Alternative	Additional Inundation Area	Total Reservoir Inundation Area[1]	Dam Enlargement	Roads[2]	Auxiliary Spillway and Channel[3]	Quarry Sites[4]	Spoil Areas[5]	Stockpile Areas	Tree Removal[6]	Total Disturbance
Permanent Disturbance										
1a (Proposed Action) - Additional 77,000 AF (with Environmental Pool for mitigation)	400	842	2.8	1.9	12.3	10	0	0	38.6	**465.6**
1c - Additional 40,700 AF	233	651	1.9	2.0	13.2	12.5	0	0	39.1	**301.7**
8a/10a - Additional 52,000 AF	294	712	2.2	2.1	13.2	11.9	0	0	39.9	**363.3**
13a - Additional 60,000 AF	337	755	2.4	2.2	13.2	11.3	0	0	46.5	**412.6**
Temporary Disturbance										
1a (Proposed Action) - Additional 77,000 AF (with Environmental Pool for mitigation)	0	0	30.8	0	20.5	32.7	4.8	0.5	0	**89.3**
1c - Additional 40,700 AF	0	0	33.7	0	22.5	37.1	9.3	2.1	0	**104.7**
8a/10a - Additional 52,000 AF	0	0	32.3	0	22.4	35.7	6.3	1.2	0	**97.9**
13a - Additional 60,000 AF	0	0	31.1	0	21.3	34.3	5.9	0.8	0	**93.4**

Table D-1 (continued)
Estimated Ground Disturbance (Acres) - Gross Reservoir
Alternatives 1a (Proposed Action), 1c, 8a, 10a, and 13a

Notes D-1:

Permanent disturbance is the total land area that remains after reclamation to be physically altered for the life of the project. Temporary disturbance is the total land area disturbed by construction activities that would be reclaimed.

[1] The existing inundation area at Gross Reservoir is 418 acres. The total reservoir inundation areas were calculated by adding 418 acres to the additional inundation area for each alternative. It is assumed that the reservoir basin would be cleared and grubbed prior to the first fill.

[2] The permanently relocated roads include the north spillway access road, the south spillway access road, and the north dam access road. The temporary construction areas for the quarry sites access road are included in the construction disturbance areas for the quarry sites (see Footnote 4). The temporary construction staging area for the relocated dam roads are accounted for in the temporary dam enlargement construction calculations. The temporary construction access road to the spillway is included in the spillway construction calculations (see Footnote 3).

[3] The permanent construction disturbance area for the auxiliary spillway includes the spillway and the channel. Temporary construction disturbance varies by alternative as summarized in the table.

[4] The permanent disturbance area for the quarry sites (i.e. benched and primary) includes the areas located above the reservoir inundation level for each alternative. The area below the reservoir pool is included in the permanent disturbance for the reservoir under the "Additional Inundation Area" column. The temporary disturbance area includes the total area of the quarry site, plus the construction disturbance area. The area of temporary disturbance represents the amount of disturbed area that would remain exposed after inundation; therefore, the smaller the reservoir expansion, the greater the area of "temporary" disturbance shown in the table.

[5] The temporary disturbance associated with the spoil areas is a total of two sites that are located north and south of the dam.

[6] Vegetation will be removed between the existing normal pool elevation (7,282 ft) and above the expanded reservoir pool for each alternative, as summarized below:
- Alternative 1a (Proposed Action) 7,406 ft (with the Environmental Pool for mitigation) and 7,410 ft.
- Alternative 1c 7,357 ft and 7,367 ft.
- Alternatives 8a/10a 7,374 ft and 7,384 ft.
- Alternative 13a 7,385 ft and 7,395 ft.

Table D-2
Estimated Ground Disturbance (Acres) - Leyden Gulch Site
Alternative 1c

Alternative	Reservoir[1]	Dam	Inlet/Outlet Works[2]	Staging and Spoil Areas[3]	Roads[4]	SH 93 Re-alignment [5]	Total Disturbance
Permanent Disturbance							
1c	332.0	41.2	3.0	0	5.7	7.1	**389.0**
Temporary Disturbance							
1c	0	53.4	64.6	58.4	0	0	**176.4**

Notes:

Permanent disturbance is the total land area that remains after reclamation to be physically altered for the life of the project.
Temporary disturbance is the total land area disturbed by construction activities that would be reclaimed.

[1] It assumed that the reservoir basin would be cleared and grubbed prior to construction activities.

[2] Disturbance associated with inlet/outlet works includes: the emergency outlet (0.04 acre); the bridge over the outlet tunnel (0.004 acre); the discharge structure to the South Boulder Diversion Canal (0.20 acre); the South Boulder Diversion Canal diversion structure (0.31 acre); the South Boulder Diversion Structure to Leyden Gulch (1.93); and the tunnel portal (0.56). Temporary impacts include construction staging and spoil areas associated with the permanent facilities. Temporary disturbance is also associated with pipeline trenching.

[3] Disturbance associated with the staging and spoil areas is a calculated total of three sites: north of the reservoir pool (41.23 acres), north of Ralston Reservoir (3.54 acres), and at the west abutment of the dam (13.68 acres).

[4] Disturbance associated with roads are a total of access roads to the emergency outlet (0.108 acres), the north tunnel portal (2.22 acres), the south tunnel portal (1.11 acres), the dam crest (1.77 acres), and the diversion structure (0.51 acre). Temporary disturbance for the tunnel portal roads are included in temporary disturbance associated with the outlet works. The temporary disturbance associated with dam crest road and diversion structure are included in temporary disturbance associated with the dam construction.

[5] The permanent disturbance associated with the Highway 93 is a re-aligned portion of the road that would be approximately 4,000 feet long and 77 feet wide. The temporary construction disturbance area for the Highway 93 re-alignment is included in the construction disturbance area for the dam.

Table D-3
Estimated Ground Disturbance - South Platte River Facilities
Alternatives 8a and 13a

Alternative	Dechlorination Facility (acres)	Advanced Water Treatment Plant (acres)	Diversion and Outlet Structure[1] (acres)	Gravel Pit Pump Stations[2] (acres)	Conduit O Pump Stations[3] (acres)	Conduit O Crossings[4] (acres)	Gravel Pit Pipeline Crossings[5] (acres)	Gravel Pit Pipelines[6] (miles)	Conduit O[7] (miles)	Total Length of Pipeline Disturbance (miles)	Total Disturbance Area (acres)
Permanent Impacts											
8a	0.1	4.0	0.1	1.6	1.6	0	0	0	0	**0**	**7.4**
13a	0.1	4.0	0.1	1.6	1.6	0	0	0	0	**0**	**7.4**
Temporary Impacts											
8a	0	7.0	1.6	1.2	1.2	7.4	1.5	2.1	25.2	**27.3**	**19.9**
13a	0	7.0	1.6	1.2	1.2	7.4	2.6	5.5	25.2	**30.7**	**21.0**

Notes:
Permanent disturbance is the total land area that remains after reclamation to be physically altered for the life of the project. Temporary disturbance is the total land area disturbed by construction activities that would be reclaimed upon completion of construction activities.

[1] The diversion structure and outlet structure would be located at Worthing Pit. Permanent disturbance is a sum of the diversion structure (0.1 acre) and outlet structure (0.01 acre). Temporary disturbance for the diversion dam structure includes a 0.7 acre staging area and a 0.6 acre pipeline corridor. Temporary impacts associated with the outlet structure are 0.3 acre.

[2] The permanent disturbance area for the gravel pit pump stations was calculated by multiplying the footprint of each site (0.52 acre) by the number of proposed locations (3). The temporary disturbance associated area was calculated by multiplying the construction disturbance area of each site (0.40 acre) by the number of proposed locations (3).

[3] The permanent disturbance area for the Conduit O pump stations was calculated by multiplying the footprint of each site (0.52 acre) by the number of proposed locations (3). The temporary disturbance associated area was calculated by multiplying the construction disturbance area of each site (0.4 acre) by the number of proposed locations (3).

[4] Conduit O crosses: US 36 (2.10 acres); I-25 (3.51 acres); and the South Platte River (1.77 acres). All crossings would create temporary disturbances.

[5] The gravel pit pipeline crosses: the South Platte River (1.07 acres) under Alternative 13a and C470/Northwest Parkway (1.52 acres) under Alternatives 8a and 13a. All crossings would create temporary disturbances.

[6] The gravel pit pipelines and extensions are assumed to be constructed within existing roads, curb-to-curb. Therefore, only a temporary linear disturbance was calculated.

[7] Conduit O is assumed to be constructed within existing roads, curb-to-curb. Therefore, only a temporary linear disturbance was calculated.

Table D-4
Estimated Ground Disturbance - Denver Basin Aquifer Facilities
Alternative 10a

Alternative	Well Facilities[1] (acres)	Advanced Water Treatment Plant (acres)	Conduit M Pump Stations[2] (acres)	Conduit M Crossings (acres)[3]	Denver Basin Distribution Pipeline Crossings[4] (acres)	Conduit M[5] (miles)	Denver Basin Distribution Pipeline[6] (miles)	Total Length of Pipeline Disturbance (miles)	Total Disturbance (acres)
Permanent Disturbance									
10a	13.5	4.0	1.6	0	0	0	0	**0.0**	**19.1**
Temporary Disturbance									
10a	10.8	7.0	1.2	3.6	2.7	18.5	36.0	**54.5**	**25.3**

Notes:

Permanent disturbance is the total land area that remains after reclamation to be physically altered for the life of the project.
Temporary disturbance is the total land area disturbed by construction activities that would be reclaimed upon completion of construction activities.

[1] Well Facility - includes a well house or a vault, 2 transformers, 3 injection/recovery wells, and associated piping to connect the wells to the well house or vault. The total permanent disturbance for each well facility is 0.50 acre multiplied by 27 sites. The total temporary disturbance for each well facility is 0.40 acre multiplied by 27 sites.

[2] The permanent disturbance area for the Conduit M pump stations was calculated by multiplying the footprint of each site (0.52 acre) by the number of proposed locations (3). The temporary disturbance area for the Conduit M pump stations was calculated as the footprint for each site (0.40) by the number of the proposed locations (3).

[3] Conduit M crosses the South Platte River at two locations (1.92 acres; 1.63 acres). Both crossings would create temporary disturbances.

[4] The Denver Basin distribution pipelines crosses: Sand Creek at Smith Road (0.20 acre); A ditch on Decatur Street (0.03 acres); Cherry Creek near Alamo Placita (0.37 acre); Cherry Creek near Monaco Parkway (0.78 acre); Cherry Creek at 11th Avenue (0.12 acre); the South Platte River at Pasquinel's Landing (0.72 acre); and the South Platte River at 13th Avenue (0.45 acre). All crossings would create temporary disturbances.

[5] Conduit M is assumed to be constructed within existing roads, curb-to-curb. Therefore, only a temporary linear disturbance was calculated.

[6] The Denver Basin distribution pipelines are assumed to be constructed within existing roads, curb-to-curb. Therefore, only temporary linear disturbance was calculated.